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Blue macaws – 15 years of study in the Pantanal

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SUMMARY

The Blue Macaw Project, which was created from a personal initiative, has been operating uninterrupted for 15 years with the support of various institutions, companies and NGOs. Throughout the Project, studies have been conducted on the biology, ecology, behaviour, genetics, conservation, health, nutrition and development of management techniques to increase the reproductive success of blue macaws (*Anodorhynchus hyacinthinus*) in the Pantanal. In addition to nest monitoring, research and management research, the Project also conducts conservation education, eco-tourism and RPPN (Reserva Particular do Patrimônio - private natural heritage reserve) creation, which benefits other large macaws and 17 other species that use cavities to breed. Hundreds of academics and recent graduates were trained in the field activities developed by the Project, as well as started other projects in Brazil and South America. Dozens of scientific works have been published in books, articles and congresses in Brazil and abroad. Hundreds of disclosures, in presentations and in print, in different media, were passed on to the lay public, making the Project well known nationally and internationally. As a main result the population of blue macaws in the Pantanal of Mato Grosso do Sul has increased and expanded in recent years; The community at large has supported and participated in conservation processes.

Index terms - blue macaw, biology, management, conservation

ABSTRACT (In English in the original)

The Hyacinth Macaw Project, created as a personal enterprise, operated non-stop over these 15 years because it could count on the support of a number of institutions, companies and NGOs.

Through the Project the biology, ecology, behaviour, genetics, conservation, health and nutrition of the Hyacinth Macaws (*Anodorhynchus hyacinthinus*) has been studied and techniques of management to increase their reproductive success in the Pantanal were developed. Besides nest monitoring, investigative research and management, the Project also promotes conservation education activities, incentivates ecological tourism and the creation of private natural heritage reserves, which ends up benefiting other large macaws and over 17 other species that use cavities to reproduce. Hundreds of scholars and newly graduated students were trained in the field activities developed by the Project, and began other projects in Brazil and South America. Dozens of scientific works were published in books, articles and congresses inside Brazil and abroad. Hundreds of disclosures, in presentations and articles, in different media, were provided for the general public, which made the Project well known nationally and internationally. As a result the main Hyacinth Macaw population in the Pantanal of Mato Grosso do Sul has increased and expanded in recent years with the general community supporting and participating in the conservation process.

Index Terms – hyacinth macaw, biology, management, conservation.

INTRODUCTION

In tropical regions, most large parrot populations are in danger of extinction or declining due to a combination of hunting, habitat loss and trapping for the pet market (JUNIPER & PARR 1998, SNYDER et al., 2000 and WRIGHT et al. al., 2001). Unfortunately the basic biology of parrots, and especially large macaws, is poorly known, which makes conservation more difficult. In general, macaws are charismatic birds with colourful plumage, easily adapted to captivity, good interaction with human beings and the ability to imitate the human voice. And it is precisely for these characteristics that they are one of the most endangered bird groups in the world. According to GALETTI (2002) Brazil is home to 72 recognised parrot species, of which 17 are at risk of extinction. Two species have already become extinct after the arrival of Europeans in Brazil (*Anodorhynchus glaucus* and *Cyanopsitta spixii*), one is critically endangered (*Anodorhynchus leari*), seven are threatened, six vulnerable and one near threatened (*Pyrrhura lepida*). As an example we can cite the blue macaw (*Anodorhynchus hyacinthinus*), the largest representative of the parrot family. Cited in the Endangered Brazilian Fauna and in Appendix I of CITES, the blue macaw had its population greatly reduced due to three main

factors: capture for national and international trade, destruction of its habitat and the collection of feathers for indigenous adornments. In 1987 the population of blue macaws in the wild was estimated at 2,500 to 3,000 individuals (MUNN et al., 1987). With a shrinking population and virtually no studies on biology, ecology and behaviour in their natural environment, the situation of blue macaws in the Mato Grosso do Sul Pantanal began to change with the setting up of the Blue Macaw Project in 1990 (GUEDES, 1993). GUEDES & HARPER, 1995). The Project was created from a personal initiative after encountering a flock of blue macaws in the Pantanal in November 1989, being enchanted with the species and discovering that they were almost certain to disappear from the wild. The first studies were the basis for a master's dissertation, but the research continued after its conclusion with the support of some institutions, companies and NGOs. Currently the Blue Macaw Project has been working in partnership with UNIDERP, WWF Brazil, Toyota, Caiman, Brazil Telecom, Vanzin Escapamentos, FMB and the technical collaboration of the USP Department of Biology.

The main objectives of the Blue Macaw Project are: 1) the maintenance of a viable population in the medium and long term in their natural environment; 2) spreading the importance of biodiversity conservation.

The Blue Macaw has been used as a flagship species because it is attractive, conspicuous and charismatic. Specific objectives vary each year, but the main ones are: marking and monitoring nests; monitoring eggs and chicks; collecting biological data; mapping nests and feeding places; managing nests, eggs and chicks; promoting environmental education and encouraging green tourism and analysing its impact

MATERIAL AND METHODS

This work has been carried out in the Pantanal, located in Central South America. The Pantanal is an extensive flood-plain partially flooded, between parallels 16 and 21°S and meridians 55 and 58°W. The Pantanal can be considered one of the most conserved biomes in Brazil and has a high concentration of birds, mammals, reptiles, amphibians and low human density. The study area has been mainly the Mato Grosso do Sul Pantanal. Most of the Project's field activities began with the registration, marking and monitoring of nests in various sub-regions of the Mato Grosso do Sul Pantanal. Egg nests and chicks were regularly monitored in the Pantanal from Nhecolândia, based on the

Nhumirim Embrapa Pantanal farm, where studies began in 1990. Subsequently, the works were extended to the Abobral region, based on the Pousada Arara Azul, at Fazenda Baú, in 1995. And currently the activity has been carried out more intensely around the Project's research bases, located in RE Caiman, Pantanal de Miranda, since 1997, and at Pousada Araraúna, of IPPAN / UNIDERP in Pantanal de Aquidauana, from 2002. The methods developed by the Project to carry out most of the activities are described in GUEDES (1993), GUEDES & HARPER (1995) and GUEDES & SEIXAS (2002).

RESULTS AND DISCUSSION Current population status

Currently indications of the occurrence of blue macaws in the wild are found in three locations: Pantanal, Central Brazil and northern Brazil. Unfortunately there is not enough information to say whether these regions are interconnected, forming a single continuous population or whether they are in three separate populations. Results of some field surveys add up to a population of approximately 6,500 individuals distributed as follows: 1) Pantanal with about 5000 macaws, is the best in nature. There was a large removal of macaws for trafficking, but today that is practically over. One of the current problems is the down-grading of the environment, mainly due to deforestation. In Mato Grosso do Sul GUEDES (2003, unpublished data) estimates 4000 macaws and the population has increased and expanded. In Mato Grosso, works by PINHO (1998) estimated about 800 individuals. In Bolivia it was practically gone and re-appeared, with about 150-200 individuals, according to DAMMERMANN (2000, personal communication). In Paraguay there are only reports of fodder in regions neighbouring the Brazilian Pantanal.

In central Brazil (confluence of the states of Tocantins, Piauí, Maranhã and Bahia), with about 800-1000 macaws, according to the most recent survey conducted by BIANCHI (2003, personal communication). According to the authors, this population is one of the most critical at the moment, as it is affected by trafficking in the Chapada das Mangabeiras region, especially in the south of Piauí and Maranhão. They remove eggs, chicks and adults and there is an advance of the agricultural frontier with removal of native vegetation for soy-bean planting. In the northern region of Brazil, including the states of Amazonas and Pará, there is reported to be approximately 500 macaws, and there may be a gap between the populations of the two states. In this region blue macaws have not been studied in the last 20 years. The most recent survey was conducted by SHERER-NETO (2004, personal communication). Until recently,

macaws were affected by the collection of feathers for indigenous handicrafts, which was banned this year and also by deforestation for livestock and agriculture.

Food

Regarding food, the macaws are highly specialized, eating essentially two species of palm nuts in each place of occurrence. According to GUEDES (1993, unpublished data), in the Pantanal, blue macaws eat mainly palm nuts: bocaiúva (*Acrocomia aculeata*) and acuri (*Scheelea phalerata*) from newborn to late adulthood. Other ingested items

less than 5% of their food in this region. Blue macaws have a sedentary life, that is, they are resident and where they occur they can be found almost all year round, not making large migrations. They are also social birds, that is, they live in family, flocks or groups and are highly conspicuous (they are curious, vocalize and appear a lot).

Nest Monitoring

In Figure 1, we can see the regions and properties that had activities developed by the Blue Macaw Project. A total of 346 natural nests were registered, georeferenced, monitored and 198 artificial nests were installed in

47 farms in the sub-regions of Nhecolândia, Abobral, Miranda, Aquidauana, Nabileque and Rio Negro, covering an area of over 400 thousand hectares in the Mato Grosso do Sul Pantanal.

Figure 1. Map of the State of Mato Grosso do Sul highlighting the nests registered in the Pantanal (smaller map) and the 47 farms that had registered natural nests or artificial nests installed by the Blue Macaw Project.

However, it should be clarified that although it has registered more than 540 nests, both natural and artificial, not all nests are still active. Natural nests are usually old, senescent trees and there is a natural dynamic where nests break, get lost while new ones also emerge. Likewise, artificial nests wear out, trees break or are removed when they are occupied by bees (*Apis mellifera*) which can cause problems with movement of people nearby. Just to illustrate, Table 1 shows the result of the number of nests monitored in 2000 in each subregion of the Pantanal. This year, 54% of the monitored nests were located in ten farms in the Miranda sub-region, where Caiman Resort stands out, with the largest

number of registered nests (N = 111, between natural and artificial ones installed).

Table 1. Number of nests and farms monitored in 2000 in various sub-regions of the Pantanal Subregion name Number of farms Number of nests Pantanal Nhecolândia 6 37 Pantanal Miranda 10 148 * Abobral Pantanal 3 56 Aquidauana Pantanal 7 29 Nabileque Pantanal 2 5 TOTAL 28 275 * Of 148 monitored nests in the Miranda Pantanal, a total of are in E. Caiman.

Regarding the formation of nests, the blue macaws do not start a cavity, but increase rapidly from small cavities, initiated by woodpeckers or twigs that leave the heart of the tree exposed. They need large cavities to fit inside, along with the

puppies. Thus, this characteristic of macaws that can be called environmental engineers is important because it makes possible the reproduction of 17 other species that occupy cavities, like them. In the Pantanal 90% of the nests are located in the manduvi, *Sterculia Apétala*.

Reproduction

Results of the Blue Macaw Project have shown that blue macaws have low reproductive rates, as most couples lay on average two eggs, but commonly only one chick survives.

As blue macaws lay from 1 to 3 eggs, in an asynchronous posture there is a high hatching rate of eggs but also high mortality of hatchlings (GUEDES et al., 2000). At birth the puppies are totally dependent on their parents, remaining long nests, on average 107 days, to which predation and mortality are exposed. The mortality rate is higher with newborns and decreases as the pups grow older. Some puppies have been reported to carry *Salmonella* (VILELA et al., 2001) and *Clamydia* (RASO et al., 2003). After the flight the young puppies are still dependent on their parents for food and the separation may vary from 12 to 18 months. Thus, some couples reproduce each year and others every two years. As a result of a partnership since the beginning of the Project, with the poultry genetics researchers from the USP Department of Biology, more than 500 pups were sampled through the collected blood. Thus, according to MIYAKI et al. (1999) the proportion of males and females born in the wild has been practically 1: 1. In addition, the genetic variability of blue macaws was found to be around 65%, which is similar for other endangered parrots and confirmed the

monogamy of some couples that had been found in the field. Among the factors that affect the reproduction of blue macaws in the Pantanal, we can mention: the low supply of cavities, although there are several large tree species, most of them do not allow the formation of cavities; the high competition, with other species that are trying to reproduce in the same period; loss of 3 to 5% of natural nests each year due to natural causes (weather) or habitat decharacterization (GUEDES, 1995).

Artificial nests

Thus, to increase the supply of cavities in 1992, the first experiments of artificial nests for blue macaws in the Pantanal began. Initially different models and materials were tested until finding one that was used by the macaws. Five years later, dozens of nests were installed, mainly in the Miranda region, which had the largest extension of pasture cultivated with isolated trees. The nests were installed in open areas, edges and interior of mountain ranges and capons. The occupation of the nests was immediate, including the blue macaws that explored about 50% of the nests, but effectively reproduced in 10-15% of them, mainly in open areas. However, the results were achieved because more than 70% of artificial nests were occupied by 17 other species that competed or interfered with the reproduction of blue macaws. This left more natural nests that were occupied by blue macaws and there was a significant increase in breeding couples. Among the species that occupied the artificial nests, we can mention: duck (*Cairina moschata*), owl (*Tyto alba*), parrot (*Amazona aestiva*), toucan (*Ramphastos toco*), acauã (*Herpetotheres cachimans*), cauré (*Falco ruficularis*) among others. The occupation of the boxes by the mallard duck is so intense that it aroused the interest of an American biologist, to carry out part of her doctoral thesis with the duck, who used the boxes installed by the Project in the Pantanal.

Nest Management

Another technique developed and being performed by the Blue Macaw Project is the management and recovery of natural and artificial nests, to avoid the loss of traditional nests and also increase the supply of cavities. As the macaws reuse their nests for several years (continuous monitoring shows nests that have been used for 12 years in a row), the loss of a nest means a huge loss to the population, which already has a shortage of nesting cavities. Thus, we seek to

recover the nests that are ending up, losing or becoming unviable to increase the time of use by the macaws. Management is performed to decrease or increase nest opening, raise nest base, reopen nest, drain nest, reshape artificial nest. Thus, cavities that are very wide open and therefore allow predators or rain showers are managed to decrease the opening. Nests that are very deep and make it difficult for pups to escape, have a raised base with the filling of stumps and sawing or opening a cavity closer to the base. Nests that fill with water, causing chick death or egg abandonment by flooding, are drained. And artificial nests that are damaged are also repaired and / or replaced. To illustrate this activity, Table 2 shows the result of occupation of nests that were managed in 2002. It is found that 50% of the active natural nests were managed. Of the natural nests managed 86% were exploited or occupied by blue macaws with egg laying, hatching and hatching. However, more than ten species, including a mammal, have also benefited from the management of both natural and artificial nests

Table 2. Result of occupation of natural and artificial nests that were managed for breeding 2002. Monitoring Result

	No. of Natural N.	No. of Artificial N.
Total Total Nests monitored in 2002	132	102
Total Nests active in the period	86	61
Total Nests Managed	43	64
Nests only explored by AA (Blue Macaw)	17	26
Nests active by AA	20	6
Nests with AA eggs	9	6
Nests with AA chicks	8	6
Nests with AA F	6	6
Nests explored by AV (Red Macaw)	2	0
Nests with parrot (<i>Amazona aestiva</i>)	1	0
Nests with vulture (<i>Coragyps atratus</i>)	4	1
Nests with duck (<i>Cairina moschata</i>)	10	21
Nests with bee (<i>Apis meliferous</i>)	3	0
Nests with a hawk (<i>Micrastur semitorquatus</i>)	1	0
Nests with a hawk (<i>Herpetotheres cachimans</i>)	0	2
Nests with a khaki (<i>Falco ruficularis</i>)	1	7
Nests with a kiwi (<i>Falco sparverius</i>)	0	1
Nests with Owl (<i>Tyto Alba</i>)	0	3

Nests with black bird (*Gnorimopsar chopi*) 0 4 4 Nest with baby anteater (*Mirmecophaga tetradactyla*) 1 0 1 Nest with other species 0 6 6 Handling eggs and young

In 2000, the Blue Macaw Committee, coordinated by IBAMA, authorized the Blue Macaw Project to conduct some experiments with egg and hatchling management. Through continuous monitoring of nests for more than ten years, it was found that historically, some couples in certain nests had preyed eggs or newly hatched chicks (hatchlings) as soon as they hatched. The objective of this activity was to test and master the technique for future use, if necessary, as well

as to serve as a parameter for other more endangered parrot species. Initially tests were performed with two types of artificial eggs: 1) wood, and 2) small hen's egg to replace the eggs of the macaws, which should remain in the nest, hatching while the original eggs were removed and brought to be artificially incubated. . The blue macaws did not accept the wooden eggs, destroying them and abandoning their nests. However, they accepted the chicken eggs, and remained incubating normally. Lab-born offspring were artificially fed imported feed specifically for newly born parrots until they were more resilient to be returned to their nests or translocated to nests with pups of similar age. Another type of management was performed in nests with two chicks that were older than five days of difference between the first and second chicks, in which the second usually does not survive. So the puppies were translocated nesting: one couple kept the two largest chicks and another couple kept the two smaller chicks. These experiments allowed the increase of couples with puppies and the number of puppies per couple, which consequently increased reproductive success in the region.

Publications and other studies

Master's dissertations, doctoral theses, monographs, book chapters, articles, lectures and dozens of presentations at national and international congresses, symposia and scientific meetings are some examples of publications made as a result of the Project. In addition, hundreds of disclosures, through written and spoken press (magazines, newspapers, videos, television and internet) to the lay community and the general population, have made the Project well known both in Brazil as abroad, being recognized as a reference for the conservation of a species. Parallel to the activities developed by the Blue Macaw Project, mainly the monitoring of nests, other research has been carried out in the area of biology, genetics, veterinary and communication, making the Blue Macaw one of the species of Psittacidae threatened with a lot of wildlife information. known today. Similarly, studies of other species such as red macaws (*Ara chloroptera*), blue and yellowy macaws (*Ara araraúna*), toucans, hawks and ducks have also been developed.

Conservation

The involvement of the local population, through pedestrians and farmers since the beginning of the Project, is certainly one of the most successful factors in the recovery of the species. The involvement of the general population through

environmental education activities and outreach contributes to the achievement of these results. The training of hundreds of interns, volunteers, biologists, veterinarians and zootechnists has allowed the expansion of these studies to other regions and also to other species. Currently, dozens of tourists from Brazil and around the world have been visiting the Pantanal in order to know the blue macaws and also the activities of the Project. Thus, eco-tourism is encouraged and oriented to be another income alternative for owners in the Pantanal, as well as to consolidate the conservation of species and the environment as a whole. Finally, it is believed that the objectives are being achieved, as it is contributing to the conservation of biodiversity; the population of blue macaws is increased and expanded; and new areas of occurrence of the species are being researched, as well as other large macaws. So the picture of the blue macaws in 1980 is being reversed, and perhaps in the near future the blue macaw may leave the list of endangered species.

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